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10/611,978	07/03/2003	Hideo Fujiwara	239658US23X	4244
22850	7590	12/26/2007		
OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314			EXAMINER CHEN, TIANJIE	
			ART UNIT	PAPER NUMBER
			2627	
			NOTIFICATION DATE	DELIVERY MODE
			12/26/2007	ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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## Office Action Summary

Application No.

10/611,978

Applicant(s)

FUJIWARA ET AL.

Examiner

Tianjie Chen

Art Unit

2627

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 23 October 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,3-21,23,24 and 26-46 is/are pending in the application.
- 4a) Of the above claim(s) 9-12 and 30-38 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 21,23,24,26-29,40,41,45 and 46 is/are allowed.
- 6) ☐ Claim(s) 1,3-8,13-18,39,43 is/are rejected.
- 7) ☒ Claim(s) 19,20,42 and 44 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- ☐ Notice of Informal Patent Application
- ☐ Other: \_\_\_\_\_

## ***Non-Final Rejection (RCE)***

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/23/2007 has been entered. Claims 1, 3-21, 23, 24, 26-46 are pending, wherein claims 9-12 and 30-38 are withdrawn from consideration.

### ***Specification***

2. The amendment for specification filed on 10/25/2005 has not been entered because it does not conform to 37 CFR 1.125(b) and (c) because: the amendment recites; "Fig. 9 schematically illustrates an example of an embodiment relating to the results described above. Here, 91 and 92 are a free layer and a pinned layer structure, respectively, or 91 and 92 are both free layer or pinned layer structures." However, Fig. 9 shows an embodiment, wherein 91 and 92 cannot be both free layer or pinned layer structures, since in a CPP spin-value element having both 95 and 95' as electrodes, 91 and 92 must be a free layer and a pinned layer structures, and 91 and 92 cannot be both free layer or pinned layer structures.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1, 3-8, 13-18, 39, and 43 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Independent claim 1 recites; "an anti-ferromagnetic layer set farther from the free layer structure than the ferromagnetic layer structure and rendering the pinned layer magnetically harder than the free layer; ..... a thin non-magnetic spacer layer structure configured to separate the free layer and the pinned layer structures, ..... at least two current-confining (CC) layer structures including at least two parts having significantly different current conductivities; ..... wherein none of the CC-layer structures are set in direct contact with said antiferromagnetic layer." However, embodiments shown in Figs. 4 and 7 do not show "wherein none of the CC-layer structures are set in direct contact with said antiferromagnetic layer" and embodiment shown in Fig. 9 does not show "a thin non-magnetic spacer layer" and "at least two current-confining (CC) layer structures." None of the embodiment reads on the amended claim 1. Therefore, one of ordinary skilled in the art to which it pertains, or with which it is most nearly connected, cannot make and/or use the invention.

Claims 3-8, 13-18, 39, and 43 are rejected for their dependence form claim 1.

In the following examination, the newly made amendment on claim 1 will not be considered; i.e. the limitation of "wherein none of the CC-layer structures are set in direct contact with said antiferromagnetic layer" will not be considered.

***Claim Rejections - 35 USC § 102***

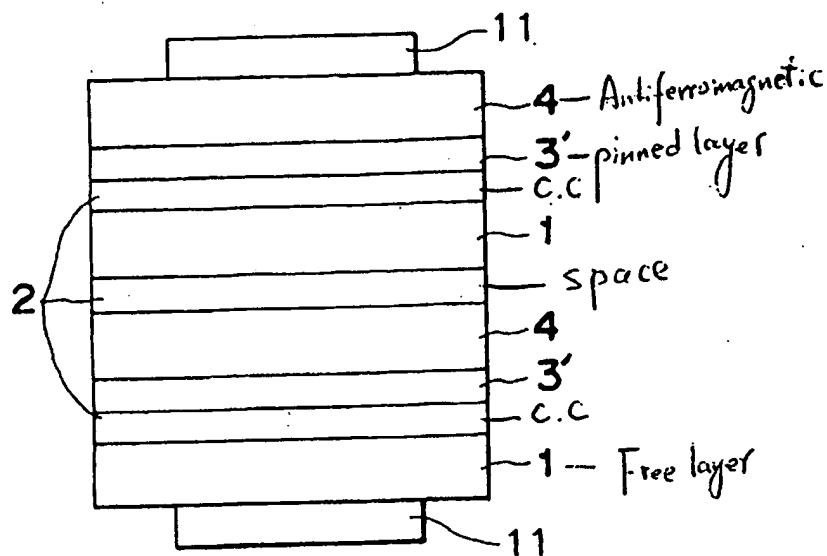
The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1, 3-8, and 39 are rejected under 35 U.S.C. 102(e) as being anticipated by Sakakima et al (US 5,715,121).

Claim 1, Sakakima et al shows a CPP spin-valve element with two electrodes 11 and 11 (Column 3, line 20) formed on an inherent substrate (See Fig. 5 attached in next page and column 5, lines 4 – 49) including: a free layer structure including at least one ferromagnetic layer; a pinned layer structure including at least one ferromagnetic layer, the free layer is magnetically softer than the pinned layer (column 4, lines 376-39); a thin non-magnetic spacer layer structure configured to separate the free layer and the pinned layer to prevent a magnetic coupling between the free and pinned layer structures, and to allow an electric current to go there through; and wherein at least two current-confining (CC) layer structures 2 including at least two parts 21 and 22 having significantly different current conductivities (Fig. 2A and 2B, column 3, lines 44-46); wherein each of the at least two CC layer structures is located on a different side of the thin non-magnetic spacer layer.



Claim 3, Sakakima et al shows in Fig. 2A that the CC-layer structure includes a mosaic structure of conducting and insulating parts (Column 3, lines 44-46).

Claims 4 and 6, Sakakima et al further shows that the mosaic structure includes metal and oxide (Column 4, lines 8-20).

Claims 5 and 7, Sakakima et al shows that the metal is Cu, the oxide is an oxides of Al (Column 4, lines 8-20).

Claim 8, Sakakima et al further shows in Fig. 5 attached above that one of the CC-layer structures is located in the vicinity of the free layer structure, and another of the CC-layer structures is located in the vicinity of the pinned layer structure.

Claim 39, Sakakima et al shows the CC-layer structures are fabricated.

A "product by process" claim is directed to the product per se, no matter how actually made, see In re Hirao, 190 USPQ 15 at 17 (footnote 3 CCPC, 5/27/76); In re Brown, 173 USPQ 685 (CCPA 5/18/72); In re Luck, 177 USPQ 523 (CCPA, 4/26/73); In re

Fessmann, 180 USPQ 324 (CCPA, 1/10/74); In re Thorpe, 227 USPQ 964 (CAFC, 11/21/85). The patentability of the final product in a "product by process" claim must be determined by the product itself and not the actual process and an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. In instant case, "with a lithography technique using a focused ion beam or an electrochemical scanning probe" is a process related limitation, which gains no weight in determining patentability.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sakakima et al in view of AAPA (Applicant Admitted Prior Art).

Claim 16; AAPA shows in P. 18 "a pair of CC-layer structures are located on both sides across the free layer structure or the pinned layer whose conducting parts are located in a cascade manner, and at least the inner edge to edge distance of a projection of the conducting parts of the CC-layers forming at least one of the current paths through at least one of the free layer structure and the pinned layer onto the layer plane is made greater than the thickness of at least one of the free layer structure and the pinned layer;" and it would provide high magnetoresistance  $\Delta R$ .

One of ordinary skill in the art would have been motivated to apply this relation into Sakakima et al's device for obtaining high magnetoresistance  $\Delta R$ .

6. Claims 15, 17, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakakima et al in view of AAPA (Applicant Admitted Prior Art).

Claims 17 and 18, AAPA shows in Applicant's Specification p. 17 the length of at least one of the current paths through at least one of the free layer structure and the pinned layer structure is greater than the spin diffusion length in at least one of the free layer structure and the pinned layer structure and is smaller than 3/or 2 times as large as the spin diffusion length of the current paths. Since AAPA show it is an optimized number, one of ordinary skill in the art would have been motivated to apply this relation into Sakakima et al's device for optimizing the performance of the device.

Claim 15, in above constructed device, at least one confined-current path is formed within every flux path 22 of a width of an exchange length of the free layer except at side edge of the free layer, which corresponds the side column 21 in Fig. 2A.

***Allowable Subject Matter***

7. Claims 21, 23, 24, 26, and 27, 28, 29, 40, 41, 45, and 46 are allowed.

Claims 19, 20, 42, and 44 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 13, 14, and 43 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, first paragraph, set forth in this Office action.

The following is a statement of reasons for the indication of allowable subject matter:



- With regard to claims 21, 23, 24, 26, and 27; as the closest reference of record, Sakakima et al (US 5,715,121) discloses a CPP spin-valve element formed on a substrate including: free layer structure including at least one ferromagnetic layer; a pinned layer structure including at least one ferromagnetic layer, the free layer is magnetically softer than the pinned layer; and a first thin non-magnetic current confining (CC)-layer structure configured to separate the free and pinned layers, to prevent a substantial magnetic coupling between said free and pinned layer structures, and to allow an electric current to go through the confined current paths; and a second CC-layer structure placed across at least one of the free layer and the pinned layer; wherein conducting parts of said CC-layers are located in a cascade manner; **but fails to show** that at least an a majority of the nearest inner edge to edge distances of a projection of the conducting parts of the CC-layers forming of the current paths through said free layer structure or said pinned layer onto the layer plane are made greater than the thickness of at least one of said free layer structure and said pinned layer.
- With regard to claims 28, 29, 45, 46, and 13, 14, 19, 20, 23, 24, 42- 44; as the closest reference of record, Sakakima et al (US 5,715,121) discloses a CPP spin-valve element formed on a substrate including: a free layer structure including at least one ferromagnetic layer; and a pinned layer structure including at least one ferromagnetic layer, the free layer is magnetically softer than the pinned layer; wherein at least one CC-layer structure is incorporated therein, which is configured to separate the free

and pinned layers and to allow an electric current to go through the confined current paths; **but fails to show** that the width of at least one of the confined current paths of said at least one CC- layer structure is greater than  $t^{3/2}$  where  $t$  is the thickness of at least one of said free layer structure and pinned layer measured in nano-meters.

- With regard to independent claim 40, as the closest reference of record, Sakakima et al (US 5,715,121) discloses a CPP spin-valve element formed on a substrate including: a free layer structure including at least one ferromagnetic layer; a pinned layer structure including at least one ferromagnetic layer; a thin non-magnetic spacer layer structure configured to separate the free layer and the pinned layer structures, to prevent a direct exchange magnetic coupling between the free and pinned layer structures, and to allow an electric current to go there through; and at least two CC-layer structures including at least two parts having significantly different current conductivities; wherein a pair of said at least two CC-layer structures are separated by the thin non-magnetic spacer layer, at least one of said at least two CC-layer structures is inserted within the at least one ferromagnetic layer of the pinned layer structure; **but fails to show** that the part of the CC-layer structures having a lower conductivity includes either a ferromagnetic or ferrimagnetic material.
- With regard to independent claim 41, as the closest reference of record, Sakakima et al (US 5,715,121) discloses a CPP spin-valve element formed on a substrate comprising: a free layer structure including at least one ferromagnetic layer; a pinned layer structure including at least one

ferromagnetic layer; a thin non-magnetic spacer layer structure configured to separate the free layer and the pinned layer structures, to prevent a direct exchange magnetic coupling between the free and pinned layer structures, and to allow an electric current to go there through; and at least two CC-layer structures including at least two parts having significantly different current conductivities; wherein a pair of said at least two CC-layer structures are separated by the thin non-magnetic spacer layer, at least one of said at least two CC-layer structures is inserted within the at least one ferromagnetic layer of the pinned layer structure or the free layer structure; **but fails to show** that the part of the CC-layer structures having a higher conductivity includes either a ferromagnetic or a ferromagnetic material.

- Applicant asserts; the present invention “is to provide a spin-valve element of a CPP structure that has a high resistance and which generates a high output signal with a low current” (Specification, p. 4).

#### ***Response to Arguments***

8. Applicant's arguments with respect to claims have been considered but are moot in view of the new ground(s) of rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tianjie Chen whose telephone number is 571-272-7570. The examiner can normally be reached on 8:00-4:30, Mon-Fri.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hoa Nguyen can be reached on 571-272-7579. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
**TIANJIE CHEN**  
**PRIMARY EXAMINER**